

# Ruffe

## *A new threat to our fisheries*

The **Great Lakes Sea Grant Network** is a cooperative program of the Illinois-Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin Sea Grant programs. Sea Grant is a university-based program within the National Oceanic and Atmospheric Administration (NOAA) that is designed to support greater knowledge and well-informed, responsible decisions about the resources of the Great Lakes, inland waters, and oceans.

Through its network of advisory agents, researchers, educators, and communicators, the Great Lakes Sea Grant Network supplies the region with usable solutions to pressing problems and provides basic information needed to better manage the Great Lakes and inland waters for both present and future generations.

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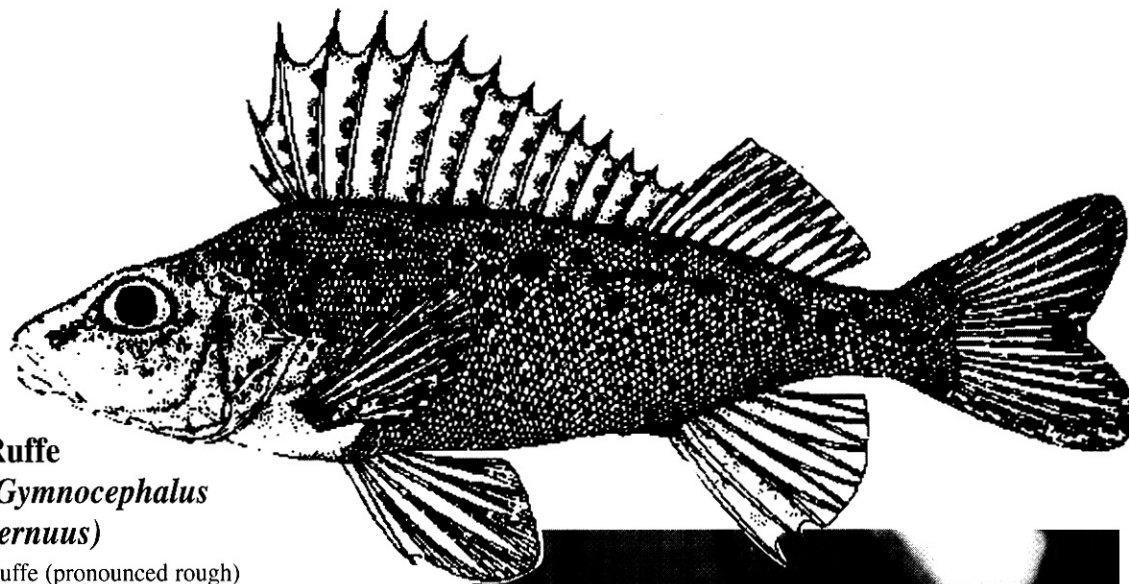
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### Ruffe (*Gymnocephalus cernuus*)

Ruffe (pronounced rough) are small but aggressive fish native to Eurasia. They were introduced into the St. Louis River, the main tributary to western Lake Superior, in the mid-1980s probably in the freshwater ballast of ocean-going vessels.

Because ruffe mature quickly, have a high reproductive capacity, adapt to a wide variety of environments, and compete with native fishes, they are considered a serious threat to the delicate predator-prey balance vital to sustaining healthy commercial and sport fisheries across North America.



### Effects of ruffe on other fish

Explosive growth of ruffe populations means less food and space for other fish with similar diets and feeding habits. Because of this, walleye, yellow perch, and a number of small forage fishes are seriously threatened by continued expansion of the ruffe's range.

To assess the impact of ruffe, the St. Louis River fish community has been intensively sampled since the invader's discovery. While it is too early to tell exactly how ruffe will affect other fish in the St. Louis River, its numbers have increased dramatically while other species, especially spottail and emerald shiners, trout perch, and brown bullhead, have declined. It remains unclear how yellow perch will be impacted. Following several years of decline, yellow perch produced good year classes in 1994 and 1995. Equally unclear is whether yellow perch will survive to adulthood due to competition with ruffe. It would be easy to blame fish community changes strictly on ruffe, but some could be the result of natural year-to-year population fluctuations or fisheries management practices.

### How fast are ruffe spreading?

Ruffe were first collected in the Duluth-Superior harbor of Lake Superior in 1986 during a routine analysis of the local fishery. Although officially identified in 1987, ruffe were probably introduced shortly before 1985. In the short time since its discovery, ruffe have increased over 100-fold to become the most numerous fish caught in bottom trawls from the St. Louis River. Based on bottom trawl samples, ruffe make up an estimated 80 percent of the fish abundance. As of 1996, ruffe have spread eastward along Lake Superior's south shore to the Ontonagon River in the Upper Peninsula of Michigan, and north to Thunder Bay, Ontario. Along the south shore, ruffe now are one of the most abundant fish in five tributaries: the Sand, Flag, Iron, Amnicon and Brule rivers. In 1995, the first sighting of ruffe outside Lake Superior occurred when three ruffe were captured in a survey near the port of Alpena, Michigan, in northern Lake Huron. The infestations at Thunder Bay, Ontario, and Alpena, Michigan, were likely due to intralake ballast water discharge. In 1996, both adult and young ruffe were found near Alpena, suggesting that ruffe are reproducing and may soon begin rapid range expansion there.

## Control strategies in the St. Louis River

Fisheries managers first tried to control ruffe by increasing the numbers of predators, especially by stocking walleye, northern pike, and muskie from 1989 through 1993. Sportfishing size limits and quotas for these species complimented this effort to maintain high numbers of large predators. Early results of the predator enhancement program have been disappointing in terms of controlling ruffe. The populations have continued to grow each year. As of 1995, researchers analyzing stomach samples of predators still found few ruffe in walleye and northern pike stomachs (<20%). Brown bullheads appear to be the only species that consistently eat ruffe, but their numbers have declined since ruffe became abundant. Research suggests that predators stocked to control ruffe may not eat them because they prefer soft-rayed shiners and

smaller hard-rayed fish like darters and young perch.

The battle to keep ruffe from spreading is being fought on several fronts. For instance, piscicides (fish toxicants) could be used to eradicate ruffe when the fish is found in small numbers at a new location. Piscicide treatments were considered for areas where the ruffe was firmly entrenched, but was ruled out because the cost would have been staggering and probably would have failed.

Piscicides were sought that kill ruffe, but leave other species unharmed. Researchers explored the possibility that ruffe are susceptible to low doses of the lampricide, 3-trifluoromethyl-4-nitrophenol or TFM, a chemical that in low doses kills lamprey, but has minimal affect on native fishes. Field tests showed that

### What do ruffe look like?

Ruffe resemble small yellow perch with walleye markings (see illustration). In fact, ruffe are a member of the perch-walleye family. An adult ruffe is about 4-6 inches long; it rarely exceeds 8 inches. At first glance, ruffe can resemble a number of young fish, including walleye, sauger, yellow perch, johnny darter, or trout-perch. But there are easy ways to tell the difference.

The most obvious difference is the ruffe's large, continuous dorsal fin, which has spots between its rays. No other fish in the Great Lakes, except the sauger, has spots like this. Unlike sauger, ruffe have a continuous dorsal fin with no notch.

**Most members of the perch family** (see illustration) have:

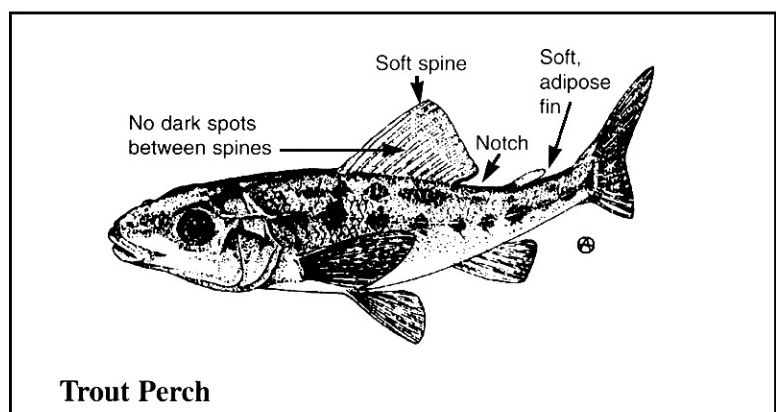
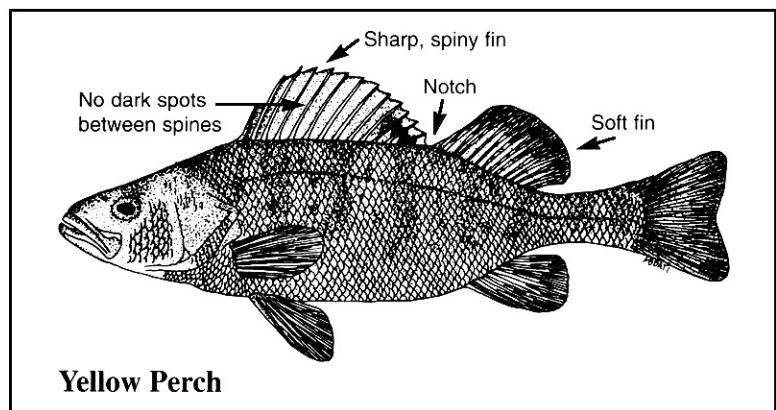
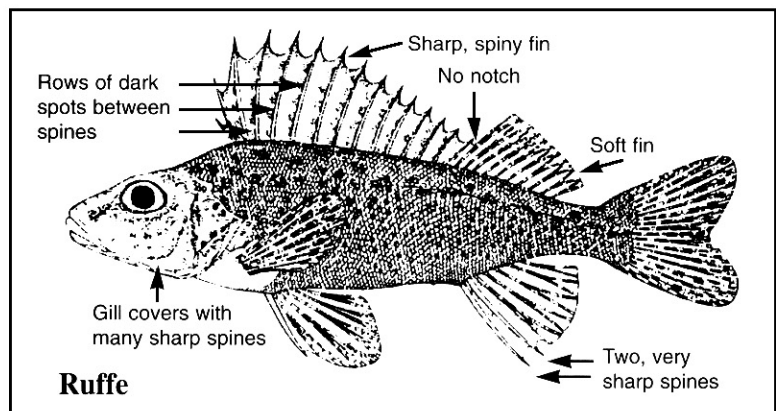
- spiny dorsal and anal fins, and
- two distinct fins on top: the front has hard, sharp spines; the back has soft rays.

**Ruffe are different from other perch** (see illustration) because they have:

- very large continuous dorsal fins, joined together, front to back, with 11-16 rays in front,
- spots between the rays on the dorsal fins,
- no notch between the front and back part of the dorsal fins,
- gill covers with many small, sharp spines,
- slightly downturned mouths, and
- no scales on their heads.

**Troutperch are often mistaken for ruffe.**

Troutperch are soft-rayed fish with a single dorsal fin, and a soft adipose fin (see illustration). Remember: No other fish in the Great Lakes except a sauger has spots between the rays on the dorsal fin, and sauger have a notch between the dorsal fins, which ruffe do not have.



Ruffe illustration: M. Baradlai, Minnesota Sea Grant.

Troutperch illustration: ©1975, Dr. W.B. Scott, used with permission.

Yellowperch illustration:

© 1957, Samuel Eddy, Wm. C. Brown Publishers, used with permission.

treating streams with TFM to control lamprey kills a high percentage of ruffe. However, TFM is registered for lamprey control only. Fisheries managers also tried to net and destroy as many ruffe as possible from infested rivers, with the hope that the ruffe's range would not expand as rapidly. Unfortunately, this didn't work. Ruffe populations came back to original levels within a year.

Some fisheries managers hoped to eradicate and control ruffe using piscicide treatments for Lake Superior rivers and streams on a case-by-case basis. This attempt to contain ruffe to western Lake Superior was thwarted by political pressure. The goal has now shifted to prevent their spread to other inland lakes and watersheds, and to slow their spread to the other Great Lakes. To that end, the U.S. and Canadian shipping industries developed voluntary guidelines for handling ballast water in Great Lakes ships. Under these new guidelines, ships going to other Great Lakes ports are required to exchange ballast in deep (at least 240 feet) water west of a demarcation line between Ontonagon, Michigan, and Grand Portage, Minnesota, and at least five miles from the south shore of Lake Superior.

## What do we really know about ruffe?

Because ruffe are relatively new to North America, fisheries managers rely on Eurasian studies that describe their life-cycle and habits. Even with these data and new studies from Lake Superior, it is difficult to predict how ruffe will act in different environments.

In Eurasia, ruffe generally mature in two or three years, but may mature in one year in warmer waters. They spawn between mid-April and July, depending on location, water temperature, and preferred habitat. Female ruffe live an average of 7 years, but may live up to 11. Males live up to 7 years, but average 3 to 5 years.

The ruffe's range now includes northeastern France, England, the rivers entering the Baltic and White Seas, the Baltic Sea, and most of Siberia. Before coming to North America, the ruffe's most recent expansion was to Loch Lomond, Scotland, where it may have been responsible for dramatic declines in relative abundance of the local perch population.

## A hearty species

Ruffe can thrive in a wide range of temperatures and habitat. They have a faster first-year growth rate than most of their competitors. They start reproducing at age 2 or 3, but in warmer waters males may reproduce after age 1. Females may reproduce after age 2, but the bulk seem to reproduce after age 3 or 4. An average female can produce 13,000 to 200,000 eggs per season. Due in part to this hearty reproductive rate, ruffe populations can rapidly increase.

In Europe, ruffe are found in fresh and brackish (salinity less than 3-5 ppm) waters and in all types of lakes — from deep, cold, and nutrient-poor to shallow, warm, and nutrient-rich. In rivers, ruffe prefer slower-moving water. In lakes, they prefer turbid waters and soft bottoms, usually without vegetation.

Unlike other perch species, ruffe are more tolerant of murky, nutrient-rich (eutrophic) conditions (see graph below). Like walleye, ruffe spend their days in deeper water, moving into the shallows to feed at night.

To avoid predators, ruffe prefer darkness. They have a well-developed system of subsurface canals on their head and lateral line that contain sensory organs called neuromasts. Such organs are common among perch species in early life stages, but they tend to atrophy as these perch reach adulthood. Adult ruffe neuromasts, on the other hand, remain sensitive and detect vibrations given off by both predators and prey. This ability gives them a competitive advantage over native fishes.

## Do ruffe eat other fish eggs?

In Europe, ruffe are known to eat eggs of other fishes, but their main diet consists of small aquatic insects and other bottom-dwelling organisms. In Lake Superior, ruffe have been found to eat the eggs of lake herring, but in the St. Louis River ruffe do not seem to eat many eggs. While fish eggs may not be part of the ruffe's regular diet in the St. Louis River, there is no guarantee that fish eggs won't be part of the ruffe's diet in other North American waters. Ruffe are opportunistic feeders — they will eat almost anything. Whether ruffe feed on fish eggs may be less important than whether ruffe eat the food required by other fish.

## Whom to contact

If you think that you've caught a ruffe, call your Sea Grant program or a local resource management agency for instructions. Never transport a live ruffe.

For more information about ruffe, contact the U.S. Fish and Wildlife Service Fishery Resources Office in Ashland, Wisconsin, 715/682-6185, or the U.S. Fish and Wildlife Service, Exotic Species Program in Amherst, New York, 716/691-5456.

For other publications or advice from local experts, contact the Sea Grant program or state natural resources management office nearest you. Phone numbers of several Sea Grant programs follow.

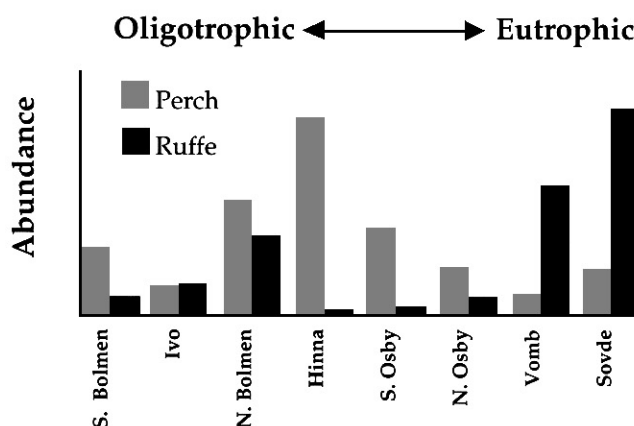
Connecticut.....	806/445-8664
Delaware.....	302/831-8185
Florida.....	904/392-1837
Illinois-Indiana.....	847/872-0140
Louisiana.....	504/388-6349
Maryland.....	410/267-5660
Michigan.....	517/353-5508
Minnesota.....	218/726-8712
Mississippi-Alabama.....	601/875-9341
Massachusetts.....	617/253-9308
Maine-New Hampshire.....	603/749-1565
New Jersey.....	908/349-1152
New York.....	800/285-2285
North Carolina.....	919/515-5287
Ohio.....	614/292-8949
South Carolina.....	803/722-5940
Texas.....	409/762-9800
Wisconsin.....	414/465-2795

Information taken from "Trophic Relations of Ruffe (*Gymnocephalus cernuus*) in the St. Louis River Harbor, Lake Superior" by Derek Ogle, June 1992.

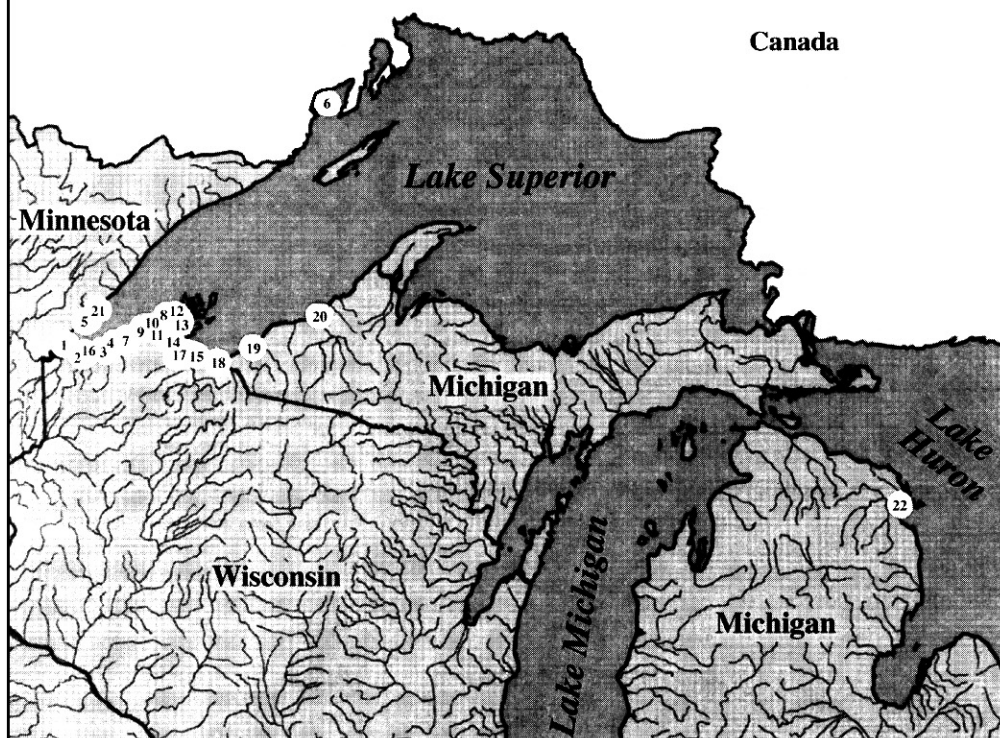
*In this graph, ruffe abundance is compared to perch in eight Swedish lakes. Perch prefer more oligotrophic conditions compared to ruffe. Ruffe seem to prefer more eutrophic conditions, but are found in all types of waters (Bergman 1990).*

## Fish Abundance vs. Trophic Status

from Maitland, 1990



## Confirmed Ruffe Sightings (*Gymnocephalus cernuus*)



### Year of First Observation

#### Lake Superior

1. St. Louis River, 1986.
2. Amnicon River, 1988.
3. Brule River, 1989.
4. Iron River, 1991.
5. Stony Point, 1991.
6. Thunder Bay, Canada, 1991.
7. Flag River, 1992.
8. Sand River, 1992.
9. Bark Bay Slough, 1993.
10. Lost Creek Slough, 1993.
11. Siskiwit River, 1993.
12. Raspberry River, 1993.
13. Red Cliff Creek, 1993.
14. Sioux River, 1993.
15. Bad River, 1993.
16. Middle River, 1993.
17. Chequamegon Bay, 1994.
18. Saxon Harbor, 1994.
19. Black River, 1994.
20. Ontonagon River, 1994.
21. Two Harbors, 1995.

#### Lake Huron

22. Thunder Bay River, 1995.



United States  
Fish and Wildlife  
Service

United States  
Geological Survey

Produced by the Biological Resources Division of the U.S. Geological Survey, Gainesville, Florida

Data Source: U.S. Fish and Wildlife Service, Ashland, Wisconsin, November 1996.

## The "bottleneck" effect

A population "bottleneck" can occur when food resources are limited at a particular life-stage of a fish species. In this case, ruffe could reduce food resources available to young native fish. Because of their sheer numbers and the variety of food they eat, ruffe could cause this bottleneck effect. The result is fewer adults of the native species because of reduced growth, survival, or recruitment.

For example, recently hatched yellow perch must consume large amounts of plankton in a fairly short time to grow to the next stage. Young yellow perch must eat larger food items such as small crustaceans, insects, and other bottom-dwelling organisms. Only after eating these food resources at this specific stage of development do yellow perch grow big enough to eat fish. If ruffe slow this growth stage by reducing food supplies when the yellow perch need it (a bottleneck), the yellow perch population may collapse.

A "Ruffe WATCH" identification card is available from Minnesota Sea Grant Program.  
218/726-8712, Fax 218/726-6556  
E-mail: djensen@mes.umn.edu

## What you can do

Ruffe can easily spread to inland waters. To prevent their spread, natural resource management agencies enforce regulations in Minnesota, Wisconsin, Michigan, and Ontario that make it illegal to transport live ruffe. As with any exotic species, anglers must take precautions not to accidentally transport ruffe in bait buckets. So, ruffe cannot and should not be used as bait by anglers in other areas.

It is now illegal to harvest wild bait fish from ruffe-infested waters including Lake Superior or its tributaries in Minnesota, Wisconsin, and Michigan. Bait harvesters, wholesalers, and retailers should take special precautions to insure that their stocks are not contaminated with this (or other) invasive species. The key to preventing the spread is learning how to identify a ruffe and knowing what to do if you find one.

